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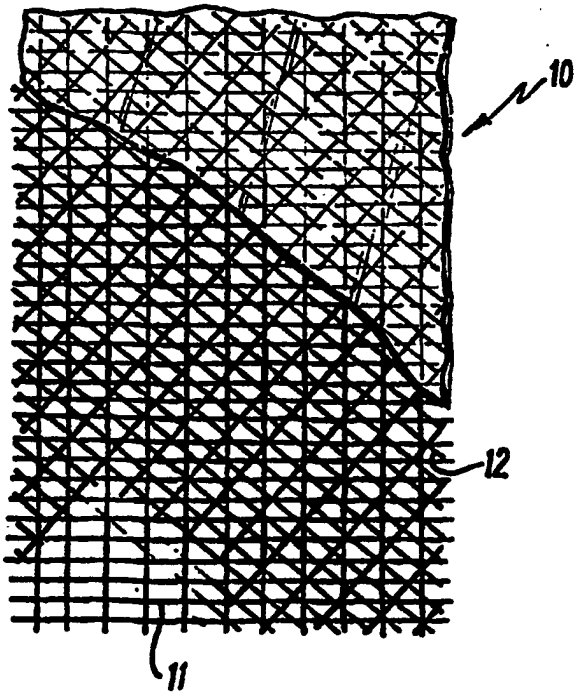
(54) Title: BELT FOR LONG NIP DEWATERING PRESSES

(57) Abstract

An extended nip press belt (10) for the press-section of a papermaking machine comprising two membranes (11, 12) in mesh form located one above the other. The lands of each mesh extend in vectors of longitudinal and transverse directions. The longitudinal lands of the first mesh are set at an angle relative to the longitudinal lands of the second mesh, the angle being less than 90°. Reinforcement yarns optionally extend in the intended running direction of the belt.



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BELT FOR LONG NIP DEWATERING PRESSES

The invention concerns improvements in or relating to long nip dewatering presses and has more particular reference to a belt for use in the context of such presses.

The long nip press section of a papermaking machine comprises an upper roller which bears down upon a stationary curved shoe to create a nip. The moist paper sheet passes through the nip, the removed water passing into one or more press felts that are in contact with the paper sheet surface(s). This paper/press felt assembly rides on a flexible press belt surface, which in turn passes over a pressure shoe, aided by oil lubrication. This flexible belt may run either as a closed circuit or be affixed to end flanges to form in effect a clad roller. A typical nip press is described in CA 1321311.

The pressure applied by the shoe and the need to maximise removal of water from the paper web impose limitations on belt design.

Shoe press belts typically comprise a woven or non-woven fabric or an array of yarns in one or more directions or a woven or non-woven fabric reinforced with additional yarns in one or more directions, coated with or encapsulated within a polymer matrix. A major problem with such belts is a phenomenon known as ballooning. Ballooning results from the pressure in the middle of the press being greater than that at the press edges, with the yarn in the woven basecloth extending differentially due to a degree of decrimping. The problem arises due to the fact that the modulus of the belt

structure in the running direction is insufficient to prevent circumferential extension in the zone of the paper web. This can led to an extension of the belt, thereby creating slack which will result in the paper web being damaged or broken. This problem is of particular concern with short shoe press belts, especially those 4.7-6.0 metres in length.

The primary object of the present invention is to provide a belt for an extended nip press which will be capable of withstanding the pressures to which it will be subjected in use without substantially prejudice to the water conveying capabilities thereof.

According to a first aspect of the present invention there is provided an extended nip press belt for the press-section of a papermaking machine, the belt comprising a first apertured membrane in mesh form and a second apertured membrane in mesh form located above the first membrane, the lands of each mesh extending in vectors of longitudinal and transverse directions, wherein the longitudinal lands of the first mesh are set at an angle relative to the longitudinal lands of the second mesh, the said angle being less than 90 degrees.

The said angle is preferably greater than 10 degrees but less than 90 degrees. The greater the angle the less the interference pattern, that is the greater the open mesh thus facilitating improved percolation of the matrix polymer, yet at higher angles, especially at 90 degrees, there is a substantially decrease in the longitudinal strength vector, which is the cause of ballooning during use.

An angle of substantially 45 degrees is ideal as this results in uniformity of mesh size so that the matrix polymer can penetrate the mesh more readily.

The belt of the invention also exhibits increased resistance to the torque forces that occur at the shoe edge regions, as the belt attempts to overcome friction and drag between the shoe and belt.

According to a second aspect of the present invention there is provided a method of making an extended nip press belt for the press-section of a papermaking machine, comprising the steps of superimposing two apertured membranes in mesh form, the lands of the mesh extending in vectors of longitudinal and transverse directions, wherein the longitudinal lands of one of the membranes are set at an angle relative to the longitudinal lands of the other membrane, the said angle being less than 90 degrees.

The belt preferably maximises the superimposition of land intersections of the two mesh membranes.

One of the membranes preferably has a left-hand bias, i.e. the longitudinal running direction lands of the membrane run at an angle to the left side of the edge of the membrane, the angle being greater than 0° and less than 90°. The similar lands of the other mesh membrane have a right-hand bias thereby producing a balanced (i.e. symmetrical) structure.

The membrane preferably comprises a synthetic thermoplastics material in mesh form. Further reinforcement yarns may also be incorporated into the belt. These

reinforcement yarns are preferably aligned in the running direction of the belt. These further load-bearing yarns may lie on top of, underneath or in the middle (i.e. between the two membrane layers) of the membrane composite, or in any combination thereof. Such further yarns may be applied by means of a bobbin that travels across the belt in an axial direction. These yarns are preferably made from high molecular weight polyethylene, polyester, polyamide, high tenacity P.V.A. or Kevlar (RTM). The load-bearing yarns increase the longitudinal strength vector in the running direction of the belt.

The double membrane layer may be obtained by separately preparing endless base cloths, for example by conventional spiral joining methods, and then superimposing the two to obtain a double layer endless sleeve.

The two mesh layers may be of identical dimensions and may have an identical or near identical solid-aperture ratio. However, more preferably one of the membrane is marginally longer than the other. One membrane may be extended by heating under tension. Alternatively one of the membranes may be deliberately manufactured to be longer than the other.

Another manner of manufacture would be to set the two membranes at different angles and cut off the non superimposed portion of both of the fabrics, such that the edges are parallel to the eventual running direction of the belt. The optionally further reinforcement yarns may be included as one or more separate layers either on the outside (above and/or below) of the membrane composite or between the two membrane

layers, or a combination thereof, all of the layers being secured together, optionally by thermal bonding.

The sleeve containing the two membranes may optionally be heat-treated prior to impregnation with a polymer so as to enhance stability and stiffness. The surface of the finished belt may be smooth, grooved or provided with blind holes on the felt side. The belt surface must be smooth on the shoe side.

In order that the present invention may be more readily understood a specific embodiment thereof will now be described by way of example only with reference to the accompanying drawings in which:-

Fig.1 shows a plan view of one of the mesh layers of a belt in accordance with the present invention;

Fig.2 shows a plan view of another mesh layer of a belt in accordance with the present invention;

Fig.3 is a plan view of a belt comprising the mesh layer of Fig.2 superimposed on the mesh layer of Fig.1 and

Fig.4 is a side elevation of the belt of Fig.3

Referring to the drawings a shoe press belt 10 comprises two superimposed membranes 11,12 encased in a polymeric material 13. Each membrane 11,12 comprises a mesh of synthetic thermoplastics material produced in accordance with the method disclosed in United Kingdom Patent Specification No. 2202873 and includes reinforcing yarns, for example of polyester or polyamide monofilament or multifilament material extending in the running direction of the belt, the reinforcing yarns being positioned in the lands existing

between adjacent apertures. The apertures are conventionally 10mm^2 square, each land suitably being 10mm in width, and having a slight taper, the membrane being 1mm thick.

Each membrane has longitudinal lands and transverse lands set at ninety degrees to the longitudinal lands. The two mesh membranes 11,12 are oriented at substantially 45 degrees to each other.

Further reinforcing yarns (not illustrated) may be included, for example by means of a bobbin that travels across the belt in an axial direction during or prior to the application of the polymer matrix material.

The belt may be made, for example, by the following method.

The first membrane is first stretched over a set of heated rollers so as to remove the slackness therefrom. The optional monofilament reinforcing yarns are then wound onto the fabric and possibly fixed onto the first membrane by means of a heat panel to melt the surface of the membrane. This application of heat must be strictly monitored in order to prevent melting of the polymer matrix.

The second membrane is now located over the welded membrane-filament reinforcement at an angle to the first membrane so as to provide the angled arrangement. The ears of the second membrane which do not overlap the first will then be cut off. Again a small amount of heat may be necessary to effect a bond, and particular to arrest any movement propensity in the filament wound yarn.

The second membrane could possibly be wound onto the

assembly without being in endless form, i.e. thin strips of the second membrane can be wound on helically. Preferably the surface of the assembly would be melted immediately prior to the second membrane being wound onto it.

An alternative method is to prepare one endless membrane by conventional spiral joining methods. Here the running direction of the yarns of the first membrane have a left-hand bias. A second membrane is then produced, identical to the first except in that its running direction yarns have a right-hand bias. The two membranes are then superimposed one upon the other to obtain a double layer endless sleeve.

Ideally one of the fabrics should be marginally longer than the other. This may be achieved by standard fabric extension methods, such as heating under tension. Alternatively the number of cells (i.e. mesh holes) provided in the longitudinal direction may be different in the two membranes. For example, if the first membrane contains 1480 cells per 8 metres, the other membrane contains 1482 cells per 8 metres.

The sleeve provided by this method is preferably heat treated prior to coating or encapsulation with matrix polymer so as to enhance stability and stiffness. This heat treatment may also be applied to sleeve/reinforcing yarn combinations.

It is to be understood that the embodiments of the invention described above are by way of illustration only. Many modifications and variations are possible.

CLAIMS

1. An extended nip press belt for the press-section of a papermaking machine, the belt comprising a first apertured membrane in mesh form and a second apertured membrane in mesh form located above the first membrane, the lands of each mesh extending in vectors of longitudinal and transverse directions, wherein the longitudinal lands of the first mesh are set at an angle relative to the longitudinal lands of the second mesh, the said angle being less than 90°.

2. An extended nip press belt as claimed in claim 1, characterised in that the said angle is greater than 10°.

3. An extended nip press belt as claimed in claim 1 or claim 2, characterised in that the said angle is substantially 45°.

4. An extended nip press belt as claimed in any preceding claim, characterised in that the longitudinal running direction lands of the mesh of the first of said membranes run at an angle to the left side of the edge of the fabric, the angle being greater than 0° and less than 90°.

5. An extended nip press belt as claimed in any preceding claim, characterised in that the longitudinal running direction lands of the mesh of the second of said membranes run at an angle to the right side of the edge of the fabric, the angle being greater than 0° and less than 90°.

6. An extended nip press belt as claimed in any preceding claim, characterised in that at least one of the membranes comprises a synthetic thermoplastics material.

7. An extended nip press belt as claimed in any preceding claim, characterised in that the belt further comprises

reinforcement yarns aligned in the intended running direction of the belt.

8. An extended nip press belt as claimed in any preceding claim, characterised in that the membranes and any reinforcement yarns are secured together by thermal bonding.

9. An extended nip press belt as claimed in any preceding claim, characterised in that the two membranes are heat-treated.

10. An extended nip press belt as claimed in any preceding claim, characterised in that the membranes are impregnated with a polymer.

11. A method of making an extended nip press belt for the press-section of a papermaking machine, comprising the steps of superimposing two apertured membranes in mesh form, the lands of the mesh extending in vectors of longitudinal and transverse directions, wherein the longitudinal lands of one of the membranes are set at an angle relative to the longitudinal lands of the other membrane, the said angle being less than 90°.

12. A method of making an extended nip press belt as claimed in claim 11, characterised in that the said angle is greater than 10°.

13. A method of making an extended nip press belt as claimed in claim 11 or claim 12, characterised in that the said angle is substantially 45°.

14. A method of making an extended nip press belt as claimed in any of claims 11 to 13, characterised in that the longitudinal running direction lands of the mesh of the first

of said membranes run at an angle to the left side of the edge of the fabric, the angle being greater than 0° and less than 90°.

15. A method of making an extended nip press belt as claimed in any of claims 11 to 14, characterised in that the longitudinal running direction lands of the mesh of the second of said membranes run at an angle to the right side of the edge of the fabric, the angle being greater than 0° and less than 90°.

16. A method of making an extended nip press belt as claimed in any of claims 11 to 15, characterised in that at least one of the membranes comprises a synthetic thermoplastics material.

17. A method of making an extended nip press belt as claimed in any of claims 11 to 16, characterised in that the belt further comprises reinforcement yarns aligned in the intended running direction of the belt.

18. A method of making an extended nip press belt as claimed in any of claims 11 to 17, characterised in that the membranes and any reinforcement yarns are secured together by thermal bonding.

19. A method of making an extended nip press belt as claimed in any of claims 11 to 18, characterised in that the two membranes are heat-treated.

20. A method of making an extended nip press felt as claimed in any of claims 11 to 19, characterised in that the membranes are impregnated with a polymer.

FIG.1

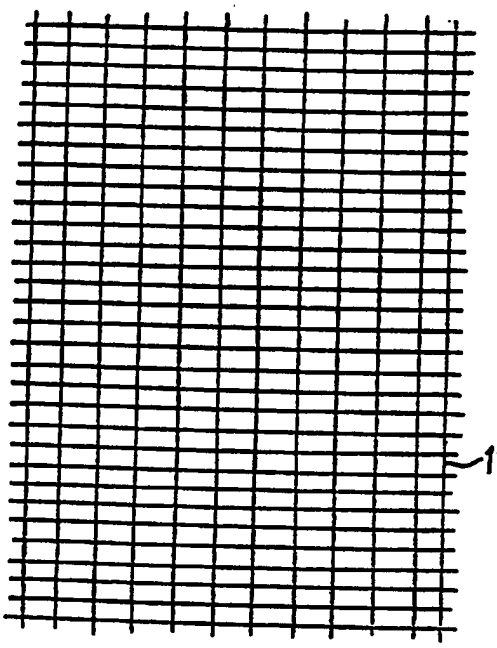


FIG.2

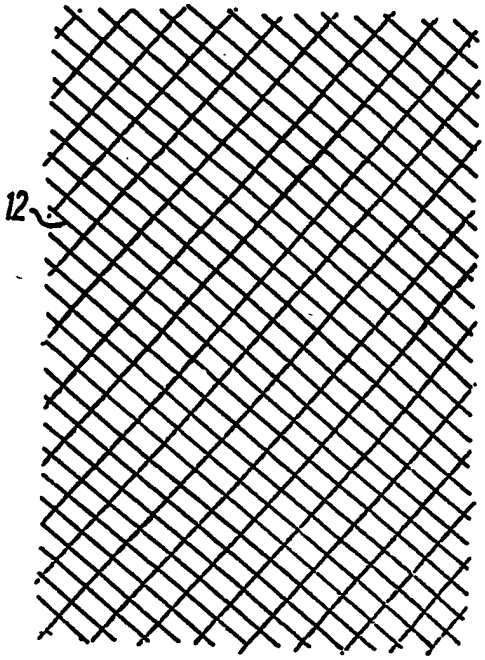
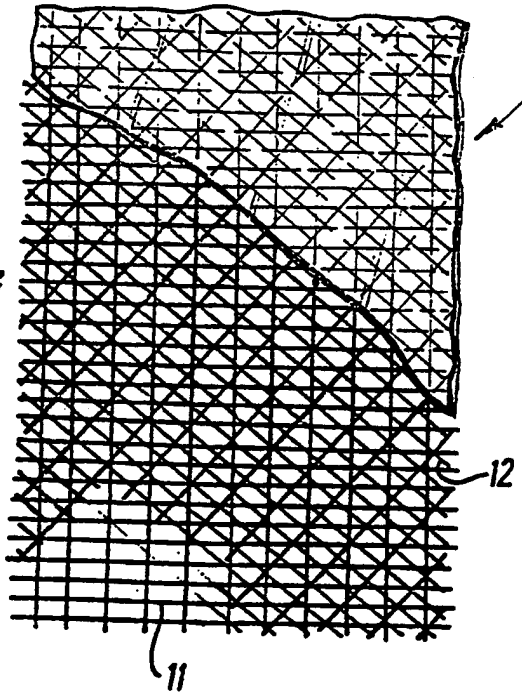


FIG.3



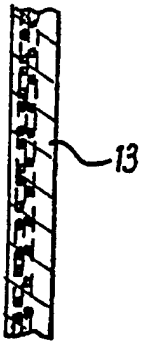


FIG.4

INTERNATIONAL SEARCH REPORT

Interna...nal Application No
PCT/GB 95/00151

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D21F3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 229 254 (GILL) 21 October 1980 see the whole document	1,2,4,5, 7,11,12, 14,15,17
A	WO,A,92 02677 (SCAPA GROUP PLC) 20 February 1992	
A	EP,A,0 396 035 (THOMAS JOSEF HEIMBACH GMBH) 7 November 1990	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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